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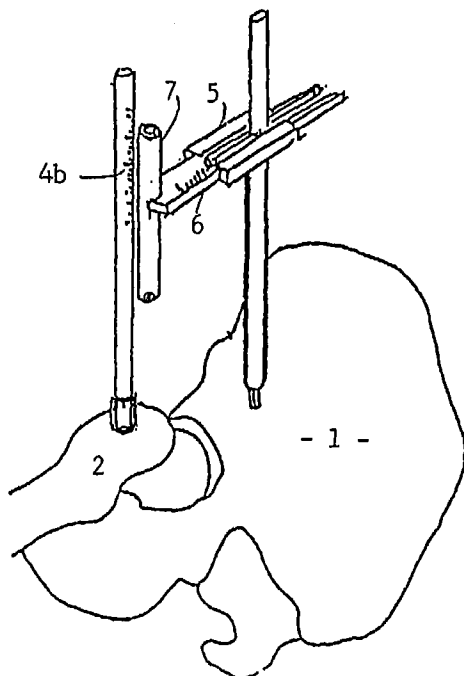
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(54) Title: AN INSTRUMENT TO DETERMINE THE MUTUAL POSITIONS OF FEMUR AND ILIUM IN CONNECTION TO HIP SURGERY



(57) Abstract: The present invention relates to an instrument to determine the mutual positions of femur (2) and pelvis (1) in connection to hip surgery to facilitate a correct fitting in and fixation of the prosthesis hip components, comprising a first threaded fixing means (3a) for a holding rod (3) carrying a slide-calliper (5/6), a second threaded fixing means (4a) detachably attached to a trochanter rod or gauge rod (4b) and to be attached in femur (2) parallel to the holding rod (3). The invention is characterised in a driving rod (4) for attachment of said second fixing means (4a), an extended casing (7) being connected to the holding rod (3) by the slide-calliper (5/6) and displaceably carries the driving rod (4) during driving of the fixing means (4a).

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**An instrument to determine the mutual positions of femur and ilium in connection to hip surgery**

The present invention relates to an instrument to determine the mutual positions of femur and ilium in connection to a hip surgery. More precisely the invention relates to an instrument making it possible to correctly fitting in and fixture of a hip joint prosthesis. By the invention an instrument is obtained being easy to handle during surgery and which provides a very high grade of certainty in obtaining a correct length of the leg, the right off-set regarding ilium and the correct joint hook of the prosthesis, mainly in view of the femur prosthesis with stem being fitted in and cemented in the femur .

In hip joint surgery it is of importance to have the surgical replacement components fixed in mutual positions corresponding to the utmost possible extent equivalent to the original positions of the joint components, i.e. femur head of femur and acetabulum of ilium or the cup of the hip-bone, provided that an adjustment of the length of the leg and/or the joint hook is not to be accomplished in connection to the surgery to compensate for other, maybe pathological changes. Thus the surgical replaced prosthesis of femur head must have essentially the same extension in the length direction in a determined angular setting to the extension of femur as was the case for the original femur condyle, and at the same time as the position of acetabulum of the hip must allow a correct bending action in a normal position of pelvis. In a total hip replacement it is also important that a correct length of the leg and a correct off-set are obtained to avoid a defective walking behaviour which easily can inflict damages on other joints and muscle attachments, especially in the back of the body. Thus it is of vital importance that concentrations of stresses are evenly distributed as ever possible and that the posture after the

surgery does not have to be changed to compensate for incorrectly implanted prosthesis components.

FR-A-2 684 287, US-A-5 122 145 and US-A-5 616 147 all relate to different instruments being intended to facilitate a correct fitting in of prosthesis components in connection to a total hip replacement. However, by the surgeons it has been observed that these prior art instruments are regarded as too fragile and hard to handle, and also indistinct to read to be of any significant help during surgery. Furthermore the Steinmann pins being used in US-A-5 122 145 have been interfering and represent a risk during some part of the operation, or the measuring-points (mortise holes) for the measuring equipment have been hard to localise.

The main object of the present invention is to obtain an instrument making it easier for the surgeon to rapidly and safely fit-in and fix joint prosthesis in correct mutual positions.

By the invention also the advantages that the fixing means for the adjusting devices will be fixed safely without disturbing the surgeon during work are obtained. The fixing means will also be easily find when refitting the adjusting devices.

Furthermore the instrument can be dismounted in different separate components which can be reused after being autoclaved.

The above mentioned object is obtained by an instrument having the characterising clauses mentioned in the claims.

The invention will now be described in connection to the drawings showing one embodiment by way of example, where

Fig. 1 is a diagrammatic view of an instrument according to the invention together with a femur head and a pelvis in an initial position and onto which a first orientation means is attached;

Fig. 2 is a diagrammatic lateral view showing the drive of an fixing means for a second orientation means using a driving rod;

Fig. 3 is a perspective drawing showing the parallelism of the orientation means;

Fig. 4 discloses a position to decide the height setting between femur and pelvis and the distance between the two orientation means;

Fig. 5 shows the femur head and pelvis after removal of the orientation means and just prior to the substitution of worn joint components;

Fig. 6 shows the final adjustment of femur and pelvis back to their initial positions prior to the final fixation of the femur prosthesis components; and

Fig. 7 show in a perspective drawing how the driving rod is used after the removal of the fixing means in the pelvis and after the completed surgery.

Fig. 1 discloses an instrument according to the invention at a femur head 2 and at a pelvis 1 in a starting-point, where a first fixing means 3a is driven into pelvis 1 using a holding rod 3 carrying a slide-calliper 5/6. The fixing means 3a will be brought through the gluteus muscles towards pelvis a couple of centimetres above acetabulum. With the patient in a side-position the fixing means 3a is driven vertically down into pelvis using a hammer

device. The fixing means 3a has a screw-threaded part being insertable into the holding rod 3 when attached thereto, i.e. the screw-threads are only intended to be used when the fixing means 3a shall be removed from pelvis 1. Generally the tip end of the fixing means 3a has a part-spherical cross section with an axially extending notch. This notch will facilitate a pulling out of the fixing means after an initial turning in axial direction of the fixing means and driving rod 4 – see further fig. 7.

In fig. 2 is shown how a driving rod 4 with attached fixing means 4a, for a later receiving of the gauge rod 4b, is carried in the casing 7 of the slide-calliper 5/6 being draw out and in, and being adjusted in such a way that the fixing means 4a will end up on an uncovered and optimal place for the fixing means on the trochanter and will be driven into it so that the fixing means 4a and the threaded part thereof rest on corticalis.

Fig. 3 shows the driving rod 4 being drawn out of the casing 7 at the slide-calliper 5/6 and being replaced by a graded trochanter rod or gauge rod 4b being screwed onto the fixing means 4a using threads arranged thereon. Thus there is only the threaded (upper) portion of the fixing means 4a being rised above corticalis.

In fig. 4 the slide-calliper component 6 is drawn backwards about 10 mm and the trochanter rod 4b is parallel with, and about 1 mm from, the casing 7. The scale on the trochanter rod is read at A as is the scale at the slide-calliper 5/6 at B. These readings are recorded and saved, if not a compensation shall be done for a previously observed length or legshortening. If that is the case the slide-calliper 5/6 is adjusted as required and/or the measure on the trochanter rod 4b.

In fig. 5 the instrument is shown removed, but the fixing means 3a and 4a is still in femur 2 and pelvis, respectively. The surgery may now proceed and the defective components – femur ball and acetabulum – are removed.

In fig. 6 the situation is shown when the prosthesis components are arranged in place, i.e. when acetabulum 1A is fixed in pelvis, but, instead of the femur head prosthesis 2A, first a testing device being inserted into femur, whereupon the trochanter rod 4b and the holding rod 3 with slide-calliper 5/6 are attached to the fixing means 4a and 3a. Then the leg is adjusted in such a way that the parallelism between casing and trochanter rod will be obtained for all directions. Femur head prosthesis is not yet finally cemented. If the length and the offset positions fail to correspond with the wanted, and maybe adjusted values, the femur prosthesis is adjusted or changed, so that the depth of the stem, the stem offset and/or the length of the neck will be achieved as wanted.

Finally fig. 7 shows how the fixing means 3a is removed using the extraction means of the driving rod 4. Said means is threaded on the fixing means 3a and by twisting the driving rod 4 the fixing means 3a is easily come loose, especially by way of the part spherical cross section of the tip.

When surgery is finished and the fixing means are removed the intention is that the holding rod 3 and the slide-calliper 5/6 are dismounted and detached to be autoclaved separately.

The invention is not limited to the embodiment above, but modifications can be done within the scoop of the appended claims.

## CLAIMS

- 1) An instrument to determine the mutual positions of a femur (2) and a pelvis (1) in connection to hip surgery to be able to make a correct fitting in and fixation of the prosthetic hip components, comprising a first threaded fixing means (3a) for a holding rod (3) carrying a slide-calliper (5/6), a second threaded fixing means (4a) detachably attached to a trochanter rod or gauge rod (4b) and to be attached in femur (2) parallel to the holding rod (3), **characterised in** a driving rod (4) for attachment of said second fixing means (4a), an extended casing (7) being connected to the holding rod (3) by the slide-calliper (5/6) and displaceably carries the driving rod (4) during driving of the fixing means (4a).
- 2) An instrument according to claim 1, **characterised in** that a threaded part of the fixing means (3a) is intended to be used at the removal of the fixing means (3a) from pelvis (1).
- 3) An instrument according to claim 1 or 2, **characterised in** that the fixing means (3a) has a tip end with a partial spherical cross section with an axially extending notch to facilitate a removal from pelvis after twisting the tip end in its drive hole in pelvis.
- 4) An instrument according to one or more of claims 1 to 3, **characterised in** that the holding rod (3) and slide-calliper (5/6) are dismountable and detachable in at least three components prior to be autoclaved and re-used.

FIG. 1

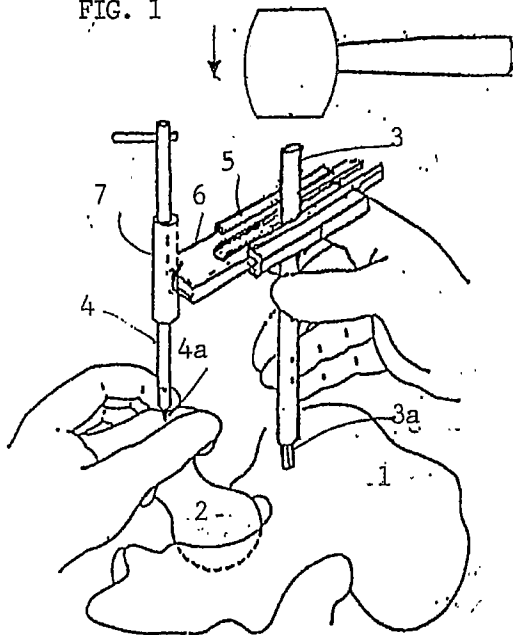


FIG. 2

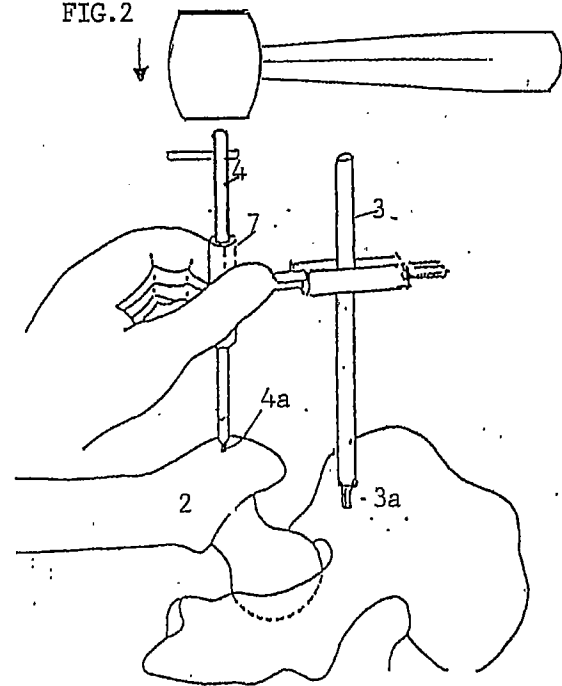


FIG. 3

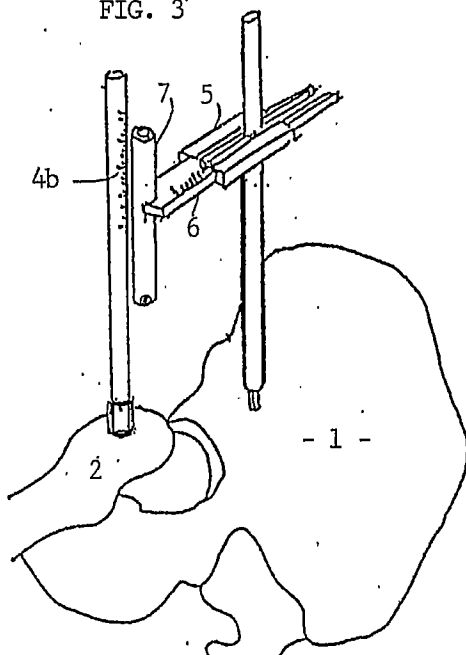


FIG. 4

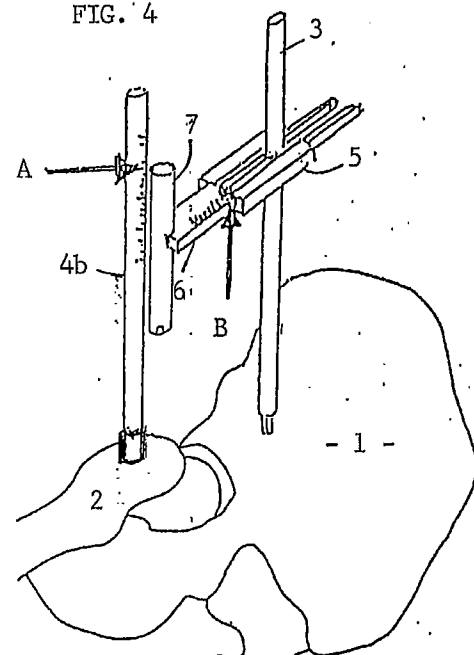




FIG. 5

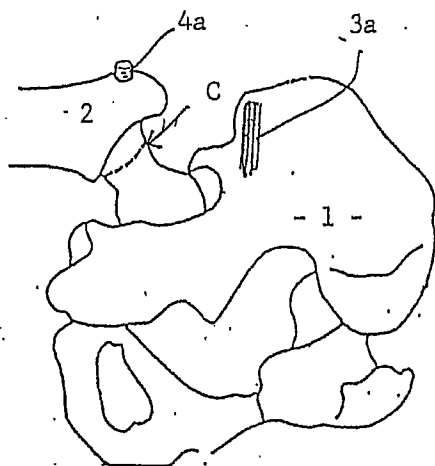


FIG. 6

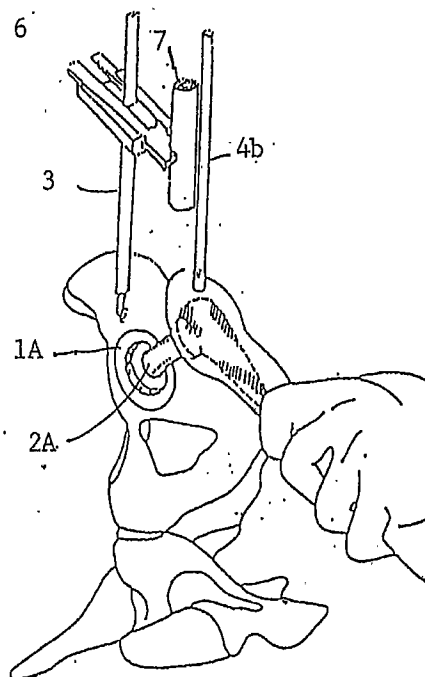
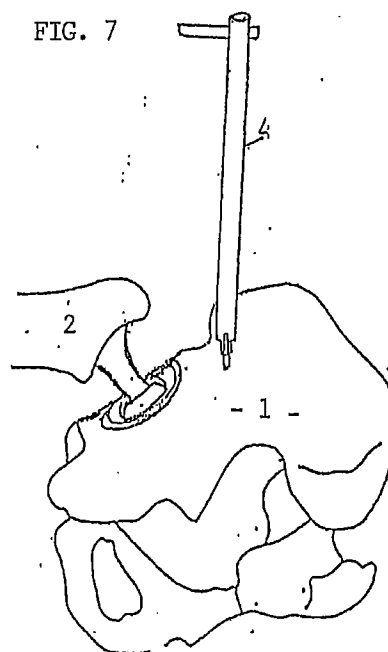


FIG. 7



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00225

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61F 2/46 // A61B 17/56

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61B, A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC INTERNAL, MEDLINE

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2659224 A1 (DORE JEAN-LOUIS), 13 Sept 1991 (13.09.91), figures 4-5 --	1-4
A	FR 2775889 A1 (GRENIER ALAIN), 17 Sept 1999 (17.09.99), figure 1 --	1-4
A	US 5616147 A (GUSTAF GADELIUS), 1 April 1997 (01.04.97), figures 2,6 --	1-4
A	US 6193724 B1 (KWAN-HO CHAN), 27 February 2001 (27.02.01), figures 18-19 -- -----	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

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Information on patent family members

29/03/03

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